

# Title of the experiment

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## Abstract

In this experiment we studied a very important physical effect by measuring the dependence of a quantity  $V$  of the quantity  $X$  for two different sample temperatures. Our experimental measurements confirmed the quadratic dependence  $V = kX^2$  predicted by Someone's first law. The value of the mystery parameter  $k = 15.4 \pm 0.5$  s was extracted from the fit. We found that this value is 20% below theoretically predicted  $k_{theory} = 17.34$  s. We attribute this discrepancy to low efficiency of our  $V$ -detector.

## 1 Introduction

Keep this section short and sweet, i.e. one paragraph. This section motivates why the experiment is interesting, and it often one of the most difficult to write. You could explain the historical importance of the experiment in the development of various physics theories (e.g. the Michelson-Morley interferometer experiment disproved the existence of the "ether"). Alternatively, you could explain the current importance of the physics that is demonstrated in your experiment (e.g. the Michelson interferometer is the basis of the LIGO gravitational wave detector). You can use the lab instructions as a starting point, but you will probably have to do a little bit of your own literature research on the experiment and associated physics (e.g. Wikipedia is a great place to start).

## 2 Theory overview

In this section, you should give a brief summary of the theory of the physical effect of interest and provide the necessary equations. Here is how you insert an equation. According to references [1–3] the dependence of interest is given by

$$u(\lambda, T) = \frac{8\pi hc\lambda^{-5}}{e^{hc/\lambda kT} - 1}, \quad (1)$$

where  $T$  is temperature in Kelvin,  $c$  is the speed of light, etc. Don't forget to explain what each variable in the equation means, when you introduce it for the first time!

### 3 Experimental setup and procedures

**Note:** LaTeX will put figures and tables at the locations where it thinks it is the best. Do not fight it, unless you really need it.

Give a schematic of the experimental setup(s) used in the experiment (see figure 1). Give the description of abbreviations either in the figure caption or in the text. Write a description of what is going on.

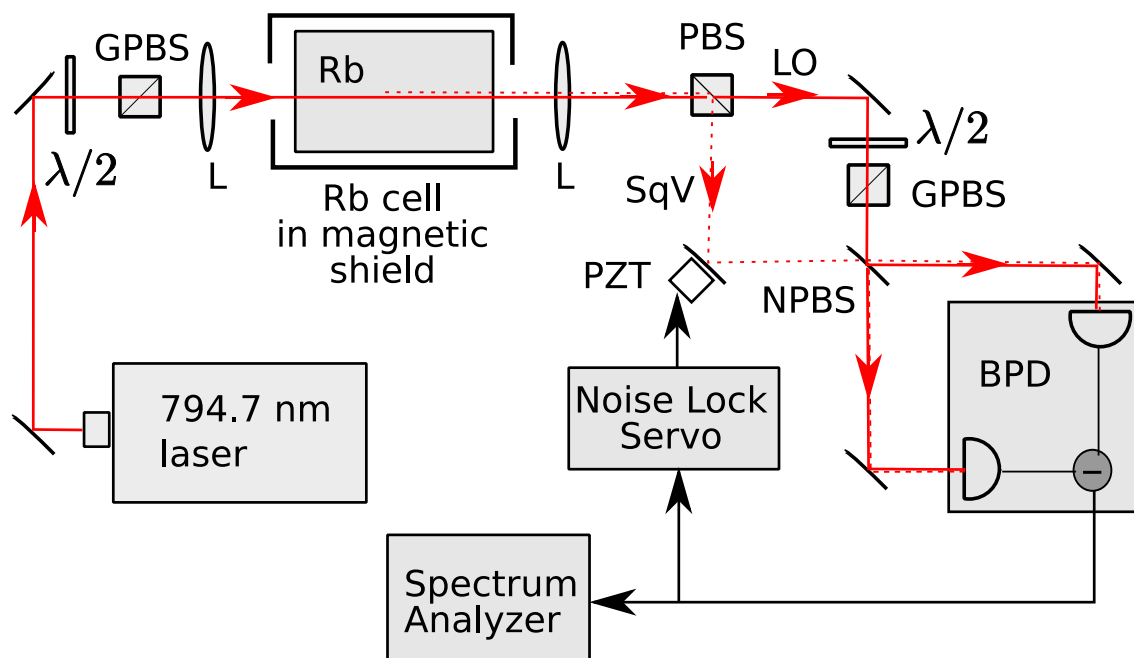


Figure 1: **Every figure MUST have a caption.** Experimental setup. SMPM fiber depicts single-mode polarization-maintaining fiber,  $\lambda/2$  is half-wave plate, PhR is phase-retarding wave plate, PBS is polarizing beam splitter, GP is Glan-laser polarizer, and BPD is balanced photodetector.

Don't forget to list all important steps in your experimental procedure!

Use active voice either in past or present through all the report and be consistent with it: The laser light comes from to ... and eventually arrived to the balanced photodiode as seen in the figure 1.

Sentences in the past voice while correct are generally considered hard to read in large numbers. The laser light was directed to ..., wave plates were set to ... etc.

### 4 Experimental data and the data analysis

In this section you will need to show your experimental results. Use tables and graphs when it is possible. Table 1 is an example.

Table 1: Every table needs a caption

Polarization	Target	Bin	$\langle x \rangle$	$\langle Q^2 \rangle$	$A_{\perp}^{meas}$	$\Delta A_{\perp}$
-	LiD	1	0.0233323	0.8429978	0.0044151	0.0030871
		2	0.0638046	1.5017358	0.0021633	0.0021343
		3	0.1892825	3.1877837	0.0006640	0.0022467
		4	0.4766562	7.1827556	-0.0197585	0.0085528
	NH <sub>3</sub>	1	0.0232572	0.8454089	0.0003600	0.0018642
		2	0.0633156	1.4870013	0.0023831	0.0013287
		3	0.1923955	3.1753302	-0.0024246	0.0013771
		4	0.4830315	7.3245904	-0.0284834	0.0047061
+	LiD	1	0.0233503	0.8340932	-0.0086018	0.0031121
		2	0.0638688	1.4785886	-0.0018465	0.0021452
		3	0.1892192	3.1277721	-0.0017860	0.0022525
		4	0.4778486	7.0313856	-0.0041773	0.0084659
	NH <sub>3</sub>	1	0.0232964	0.8439092	-0.0022961	0.0018851
		2	0.0633764	1.4814540	0.0021355	0.0013354
		3	0.1924094	3.1580557	-0.0065302	0.0013775
		4	0.4825868	7.3191291	-0.0290878	0.0047329

## 4.1 Error analysis

Analysis of equation 1 shows ...

Note: this section can be integrated with the previous one as long as you address the issue. Here explain how you determine uncertainties for different measured values. Suppose that in the experiment you make a series of measurements of a resistance of the wire  $R$  for different applied voltages  $V$ , then you calculate the temperature from the resistance using a known equation and make a plot temperature vs. voltage squared. Again suppose that this dependence is expected to be linear [2], and the proportionality coefficient is extracted from the graph. Then what you need to explain is that for the resistance and the voltage the uncertainties are instrumental (since each measurements in done only once), and they are .... Then give an equation for calculating the uncertainty of the temperature from the resistance uncertainty. Finally explain how the uncertainty of the slop of the graph was found (computer fitting, graphical method, *etc.*)

If in the process of data analysis you found any noticeable systematic error(s), you have to explain them in this section of the report.

It is also recommended to plot the data graphically to efficiently illustrate any points of discussion. For example, it is easy to conclude that the experiment and theory match each other rather well if you look at Fig. 1 and Fig. 2.

## 5 Discussion

Discuss your results. Here are some examples of discussion topics: Did everything work as planned? If a measurement did not work as well as expected, then why not? How could

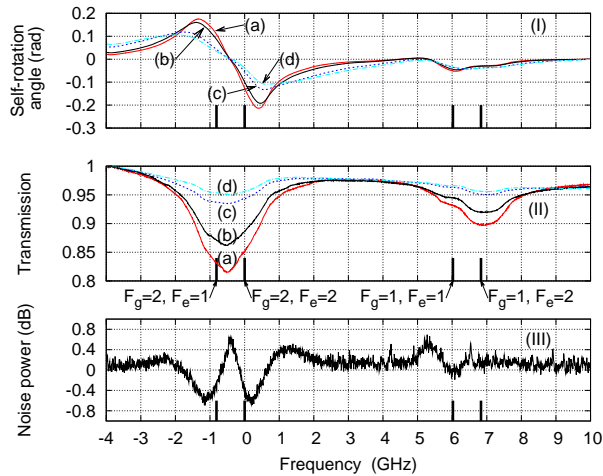


Figure 2: **Every figure MUST have a caption. Every plot MUST have axes labeled.** The dependence of self rotation and squeezing on the laser detunings.

you improve your experiment if you has a chance to do it again? How could you improve on your systematic errors?

## 6 Conclusions

Here you briefly summarize your findings.

## References

- [1] A. C. Melissinos and J. Napolitano, *Experiments in Modern Physics*, (Academic Press, New York, 2003).
- [2] N. Cyr, M. Têtu, and M. Breton, IEEE Trans. Instrum. Meas. **42**, 640 (1993).
- [3] *Expected value*, available at [http://en.wikipedia.org/wiki/Expected\\_value](http://en.wikipedia.org/wiki/Expected_value).